

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) An image processing apparatus which renders, in a screen coordinate system, unit figures each constituting the surface of a three-dimensional object to be rendered, comprising:

a rasterizing unit which divides a unit figure into a plurality of unit areas on the screen coordinate system and outputs the unit areas;

an area divider which divides each of the unit areas output from the rasterizing unit into a plurality of subareas;

an area discarder which discards ~~as necessary~~ a subarea obtained by the division by the area divider into a plurality of subareas and not including any valid pixels, which locates subareas that survived the discarding according to a predetermined rule so as to generate a merged area, and which generates positional information indicating the relative position of each subarea included in the merged area within the unit area to which the subarea belonged before the division according to a predetermined rule; and

an area writer which writes the subareas included in the merged area into a memory and which relocates each subarea in its original position by writing the subarea in an address corresponding to the positional information ~~a subarea that survived the discarding process by the area discarder into a memory.~~

2. (Currently amended) The image processing apparatus according to claim 1, wherein

the area discarder generates the merged area by sequentially locating subareas that survived the discarding and that do not include any valid pixels at the same coordinate positions in the screen coordinate system, and

when a subarea that includes valid pixels at the same coordinate positions in the screen coordinate system as any of the subareas hitherto located is input, the area discarder outputs the merged area including the subareas hitherto located and starts generating a next merged area ~~the area writer re-merges subareas that survived the discarding process and writes merged areas obtained by re-merges in the memory.~~

3. (Currently amended) The image processing apparatus according to claim 2 1, wherein each of the merged areas has the same size as the unit area.

4. (Currently amended) The image processing apparatus according to claim 1, wherein the size of the subarea corresponds to a unit throughput in which the area writer writes the subareas into the memory ~~at a time~~.

5. (Currently amended) The image processing apparatus according to claim 2 1, wherein, of the subareas that survived the discarding process by the area discarder, the area discarder ~~area writer~~ merges subareas derived from unit areas having the same coordinates in the screen coordinate system before the division.

6. (Canceled)

7. (Original) The image processing apparatus according to claim 1, wherein the unit area is a rectangular area,

the rasterizing unit divides a rendering area so that each of the plurality of unit areas includes a pixel group, the pixel number in the vertical direction and the pixel number in the horizontal direction of a pixel group in a given unit area being identical with the corresponding numbers of a pixel group in another unit area, and

the area divider divides the unit area including the pixel group into a plurality of subareas each including a small pixel group, the pixel number in the vertical direction and the pixel number in the horizontal direction of a pixel group in a given subarea being identical with the corresponding numbers of a pixel group in another subarea.

8. (Currently amended) The image processing apparatus according to claim 7 1, wherein,

of the subareas that survived the discarding, the area discarder permits merging of subareas that belonged to unit areas before the division located at different coordinate positions in the screen coordinate system,

the area discarder further generates, in addition to the merged area and the positional information, second positional information indicating the position, in the screen coordinate system, of the unit area to which each of the subareas included in the merged area belonged before the division, and

the area writer relocates each subarea in its original position by writing the subarea in an address corresponding to the positional information and the second positional information of the

~~plurality of subareas obtained by the division by the area divider, the area discarder discards a subarea that does not include any valid pixels.~~

9. (Canceled)

10. (Canceled)

11. (Canceled)

12. (Currently amended) The image processing apparatus according to claim 7 1, wherein the area writer comprises a memory access unit which writes pixels included in the subarea into the memory in parallel.

13. (Currently amended) An image processing method which renders, in a screen coordinate system, unit figures each constituting the surface of a three-dimensional object to be rendered, comprising:

rasterizing by dividing a unit figure into a plurality of unit areas on the screen coordinate system and outputting the unit areas;

dividing each of the unit areas output from the rasterizing into a plurality of subareas;

discarding ~~as necessary~~ a subarea obtained by the division into a plurality of subareas and not including any valid pixels, locating subareas that survived the discarding according to a predetermined rule so as to generate a merged area, and maintaining positional information indicating the relative position of each subarea included in the merged area within the unit area

~~to which the subarea belonged before the division obtained by dividing the unit area according to a predetermined rule; and~~

~~writing the subareas included in the merged area into a memory and relocating each subarea in its original position by writing the subarea in an address corresponding to the positional information a subarea that survived the discarding into a memory.~~

14. (Currently amended) The image processing method according to claim 13, wherein the discarding generates the merged area by sequentially locating subareas that survived the discarding and that do not include any valid pixels at the same coordinate positions in the screen coordinate system, and

when a subarea that includes valid pixels at the same coordinate positions in the screen coordinate system as any of the subareas hitherto located is input, the merged area including the subareas hitherto located is output and generation of a next merged area is started ~~the rasterizing divides a rendering area so that each of the plurality of unit areas includes a pixel group, the pixel number in the vertical direction and the pixel number in the horizontal direction of a pixel group in a given unit area being identical with the corresponding numbers of a pixel group in another unit area, and~~

~~the unit area dividing divides the unit area including the pixel group into a plurality of subareas each including a small pixel group, the pixel number in the vertical direction and the pixel number in the horizontal direction of a pixel group in a given subarea being identical with the corresponding numbers of a pixel group in another subarea.~~

15. (Currently amended) The image processing method according to claim 14 ~~13~~,
wherein
the rasterizing divides a rendering area so that each of the plurality of unit areas includes
a pixel group, the pixel number in the vertical direction and the pixel number in the horizontal
direction of a pixel group in a given unit area being identical with the corresponding numbers of
a pixel group in another unit area, and
the unit area dividing divides the unit area including the pixel group into a plurality of
subareas each including a small pixel group, the pixel number in the vertical direction and the
pixel number in the horizontal direction of a pixel group in a given subarea being identical with
the corresponding numbers of a pixel group in another subarea, ~~of the plurality of subareas~~
~~obtained by the division, the discarding discards a subarea that does not include any valid pixels.~~

16. (Canceled)

17. (Canceled)

18. (Currently amended) A ~~computer program product~~ computer-readable recording
medium having stored therein a program which renders when executed cause a computer to
render, in a screen coordinate system, unit figures each constituting the surface of a three-
dimensional object to be rendered, comprising:

a dividing module which causes a computer to divide a unit figure into a plurality of unit
areas on the screen coordinate system and outputting the unit areas; ~~and~~

a module which causes a computer to discard a subarea obtained by the division into a plurality of subareas and not including any valid pixels, locate subareas that survived the discarding according to a predetermined rule so as to generate a merged area, and maintain positional information indicating the relative position of each subarea included in the merged area within the unit area to which the subarea belonged before the division; and

a merging module which causes a computer to write the subareas included in the merged area into a memory and relocating each subarea in its original position by writing the subarea in an address corresponding to the positional information ~~retrieve, from a plurality of subareas constituting each of the unit areas output from the dividing, subareas that include valid pixels so as to generate merged areas.~~

19. (Currently amended) ~~A computer program product~~ The computer-readable medium according to claim 18, wherein

the merged area is generated by sequentially locating subareas that survived the discarding and that do not include any valid pixels at the same coordinate positions in the screen coordinate system, and

when a subarea that includes valid pixels at the same coordinate positions in the screen coordinate system as any of the subareas hitherto located is input, the merged area including the subareas hitherto located is output and generation of a next merged area is started ~~which renders, in a screen coordinate system, unit figures each constituting the surface of a three-dimensional object to be rendered, comprising:~~

~~a dividing module which causes a computer to divide a unit figure into a plurality of unit areas on the screen coordinate system and outputting the unit areas; and~~

~~a writing module which causes a computer to write subareas, of a plurality of subareas constituting each of the unit areas output from the dividing, that include valid pixels into a memory in parallel.~~